HEC Software – Modernization Goals, Status, Future Prospects

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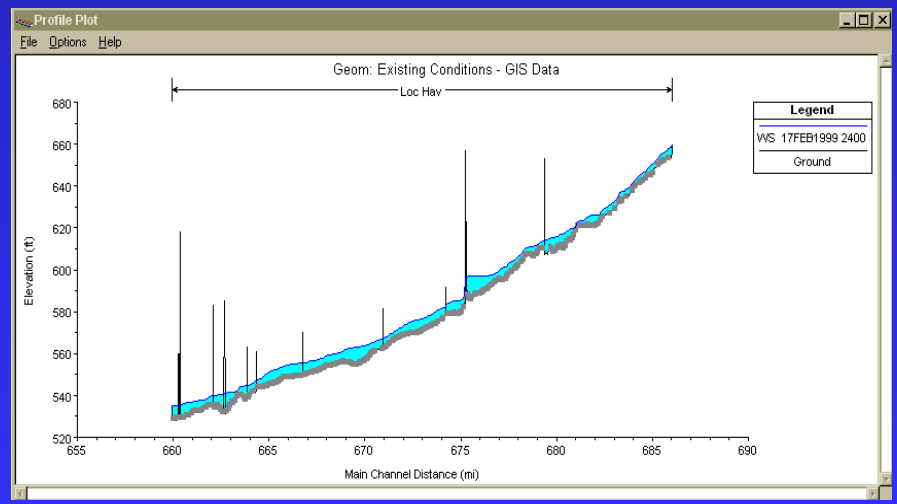


HEC Software History

- First ‘generalized’ program – 1968.
- Present: legacy (about 20); six modern (NexGen) programs and supporting utilities.
- Civil Works R&D funded; technical oversight and guidance by CECW & FRG.
- Field Office subscriptions provide for maintenance and support.
- HEC software available as public domain.

Software Development Goals

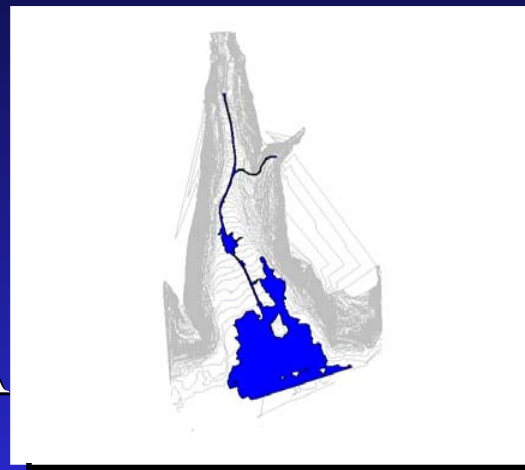
- Feature state-of-art hydrologic engineering/ planning analysis concepts and algorithms.
- Develop software for user community application.
  - Corps field offices, consultants, public.
- Modern architecture, coding, and user platforms.
- Feature graphical user interfaces, extensive displays and graphs, support integration.
- Enable efficient capability expansion, code re-usability, and minimize maintenance.
- Maintain public domain status of software.

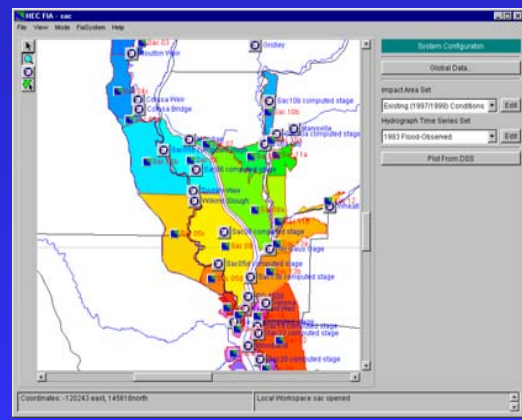
Implementing Principles

- Implement practical, proven state-of-art concepts and algorithms.
- Target both Windows and Unix platforms.
- Design with Object-oriented principles, code with appropriate language (Java).
- Develop/use re-usable 'library' codes: graphics, data mgmt., GUIs, topology, etc.
- Develop as engineering software, support with appropriate utilities (e.g. GIS).
- Develop with primarily Federal resources (to maintain intellectual property ownership), thus keep HEC Software in public domain.

Bread and Butter Packages

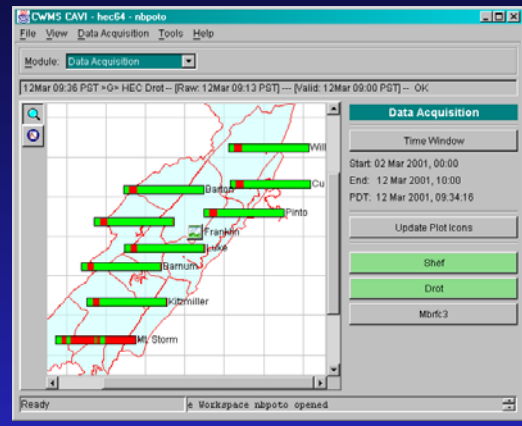
- River Hydraulics: HEC-RAS & GeoRAS, successor to HEC-2.
- Watershed Hydrology: HEC-HMS, GeoHMS, successor to HEC-1.
- Flood Damage Analysis: HEC-FDA and utilities, successor to HEC-EAD, PBA, etc.
- Reservoir Analysis: HEC-ResSim (and optimizations), successor to HEC-5.

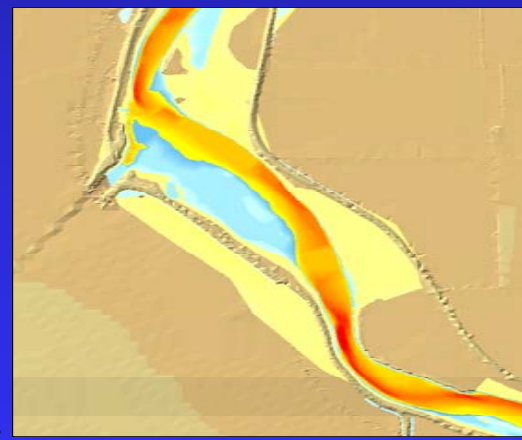




Systems Integration, Other

- Real-time water control management: Corps Water Management System (CWMS), successor to WCDS.
- Time-series data management (incl. grids), HEC-DSSVue, next generation HEC-DSS.
- River corridor/environmental restoration: Ecosystems Functions Model (EFM) – new.

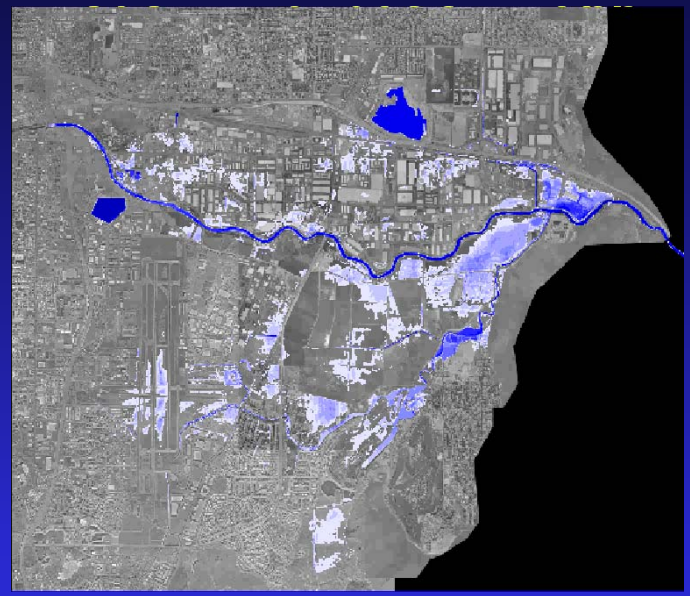


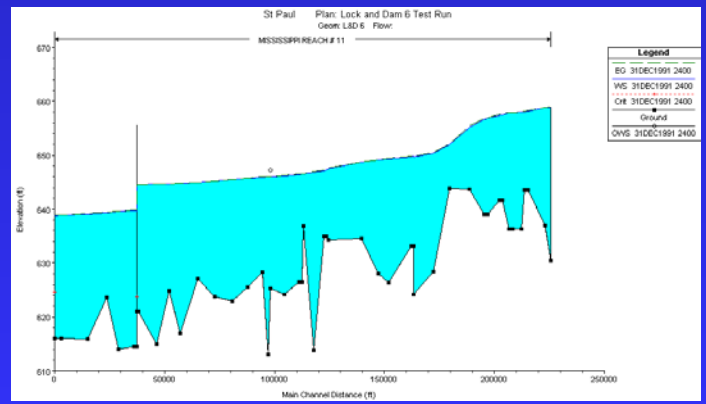


HEC-RAS, River Analysis

Version 1.0 Release 1995, Now V 3.1

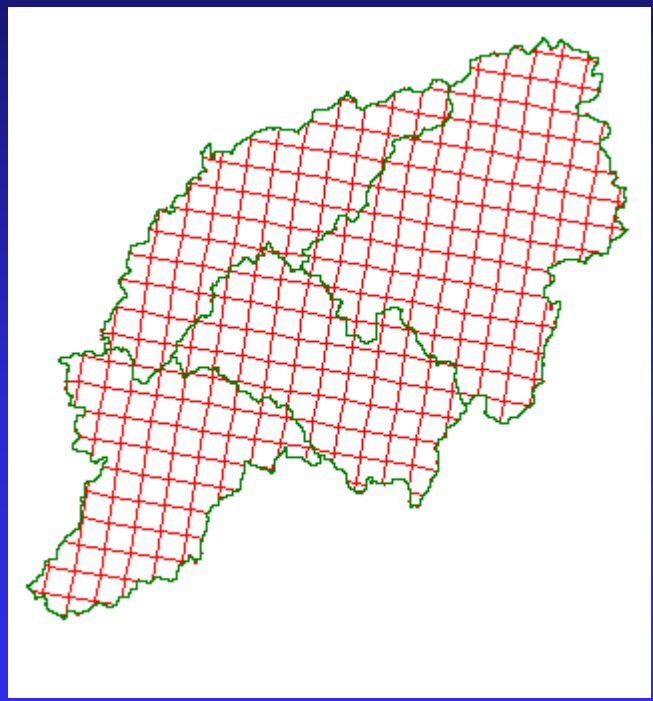
- Steady, unsteady flow, bridges, culverts, network/ quasi-2D, animation, pumps, dam/levee break, navigation locks & dams operation. Sediment transport next.
- GIS utility for geometry, inundation mapping, other parameters. ArcGIS soon.





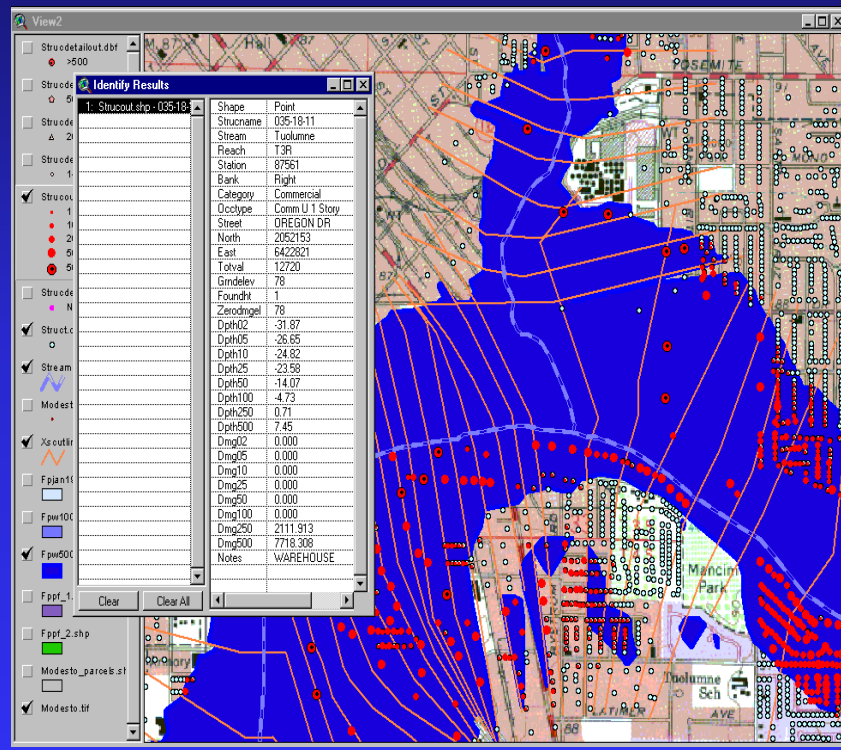
HEC-HMS, Surface Hydrology
Version 1.0 Release 1997, Now V 2.2

- Event and continuous simulation, multiple routing/ runoff methods, grid precip. & runoff, coeff. estimation, dam break, powerful GUI. Snowmelt coming soon.
- GeoHMS GIS utility for watersheds/sub-watersheds, runoff parameters. ArcGIS 8.X version underway.



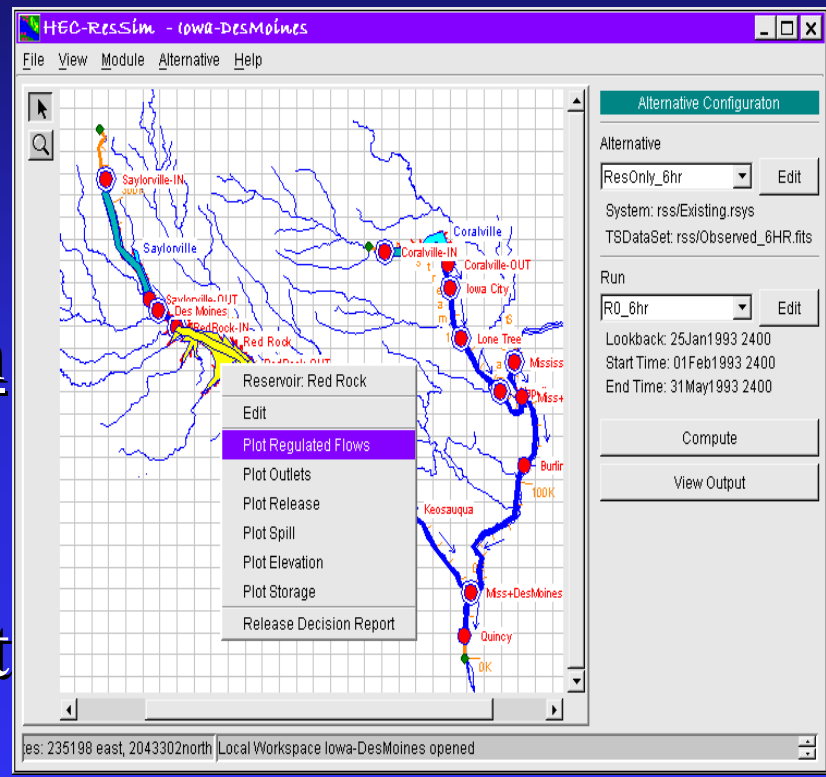
HEC-FDA, Flood Damage Analysis
Version 1.0 Release 1997, Now V 1.2

- Expected annual damage and benefits, structure inventory, reaches, H&H integration, risk analysis, project performance, alternatives comparisons.
- Several components being integrated, GIS support coming.



HEC-ResSim, Reservoir Analysis
Version 1.0 Release Spring 2003

- Rule-based multi-purpose system simulation, local hydropower, multiple outlets, network structure, integral to CWMS. System power underway, more routing methods, controls.
- Newest HEC model: latest GUI, code, graphics, etc. Optimization models also.



Reservoir Optimization Tools: HEC-PRM, HEC-FloodOpt

- Common (to ResSim) physical system description and hydrologic data.
- System operation driven by goals rather than rules, e.g. maximize objective, minimize penalty.

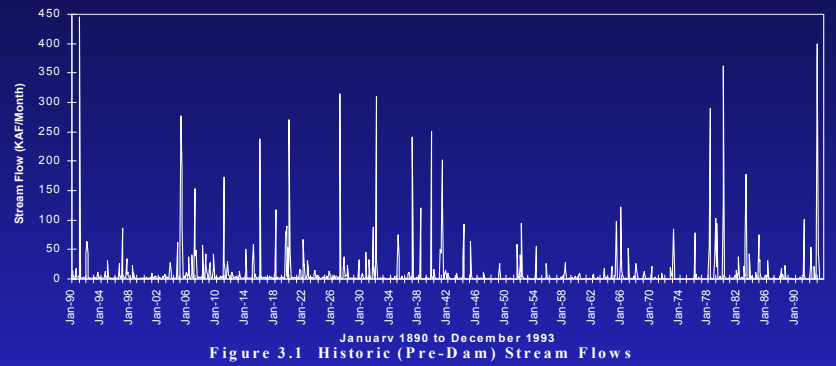


Figure 3.1 Historic (Pre-Dam) Stream Flows

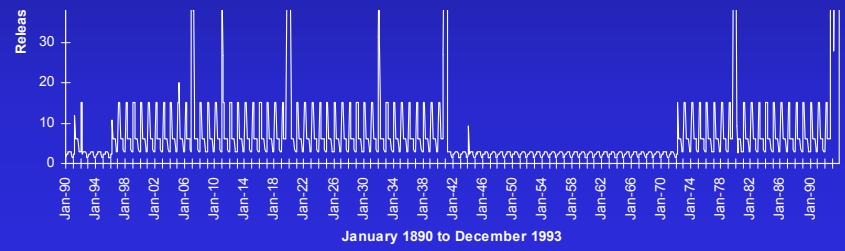


Figure 3.2 Monthly HEC-PRM Releases Based Strictly on Riparian Penalty Functions

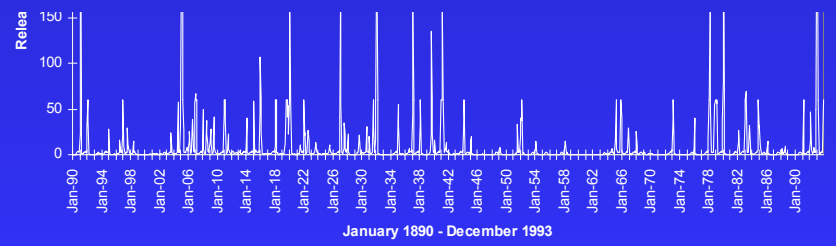
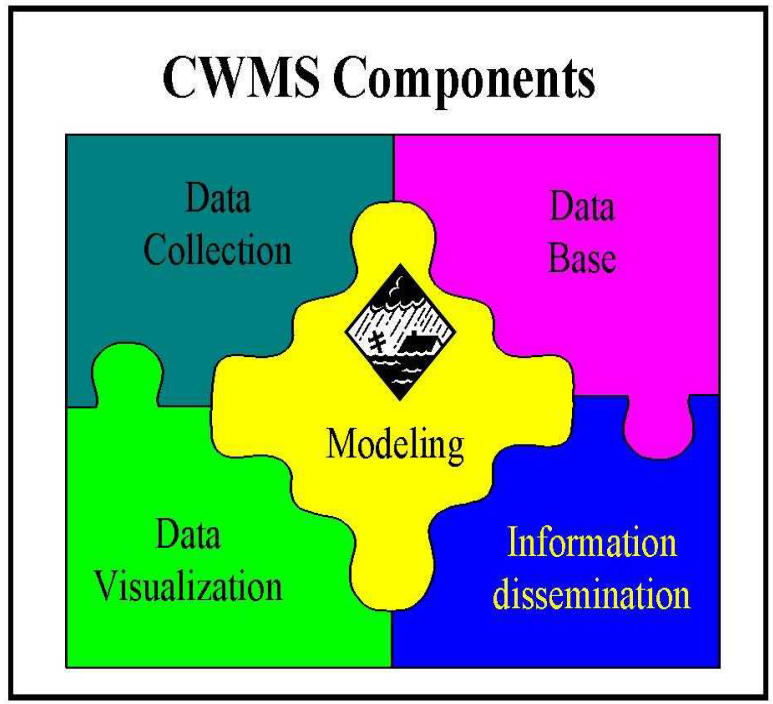


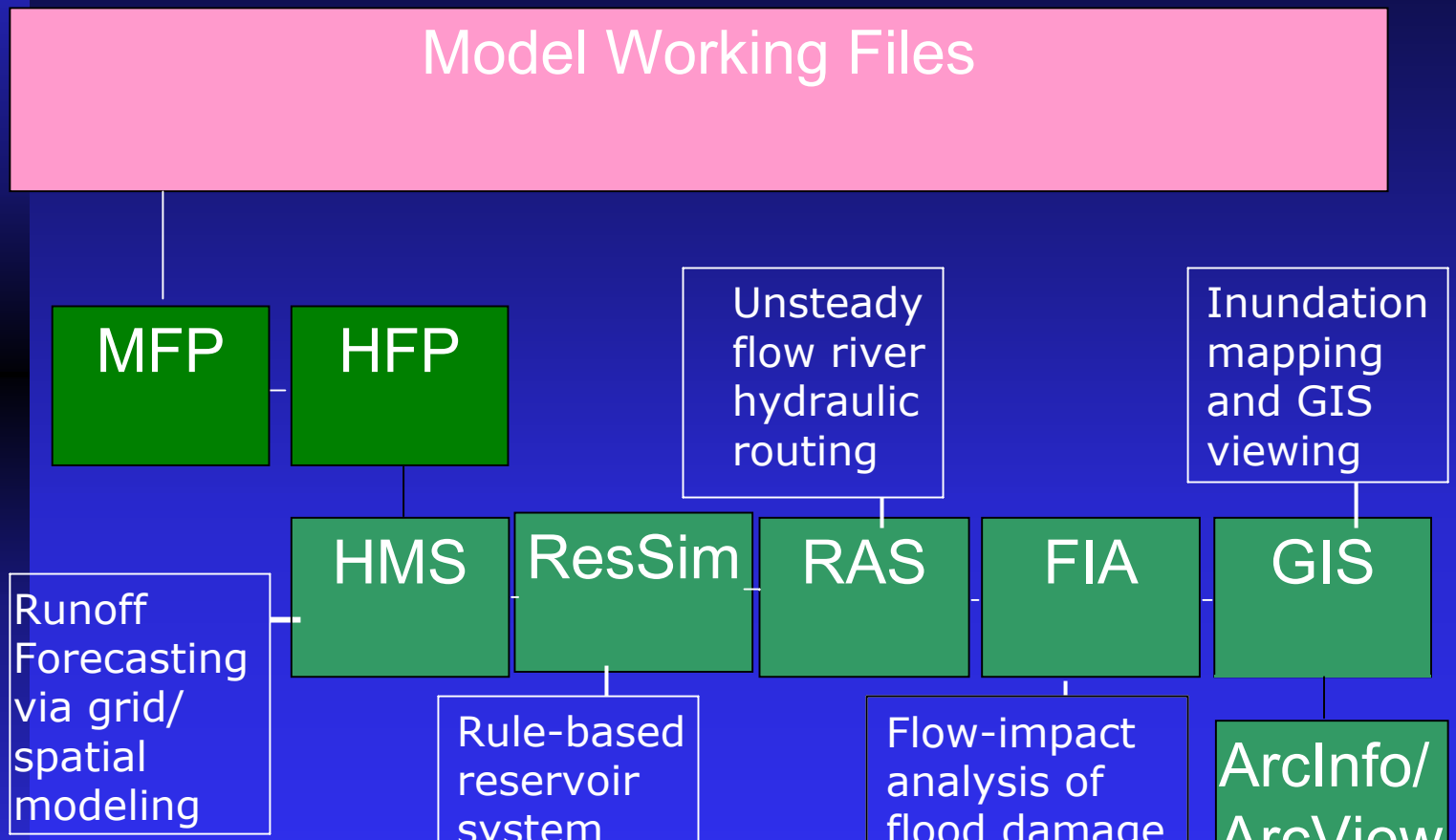
Figure 3.5 HEC-PRM Release Time Series for Composite Penalty Functi

CWMS, Water Management
Version 1.0 Deployed 2002, Now 1.1

- Corps corporate AIS for water control management. Real-time 24/7 dedicated system. Network-based client-server system. Suite of decision-support models.
- System development ’97 – ’01, deployment ’01 – 02’. Version 1.2 underway.
- Operational in all USACE district and division offices.



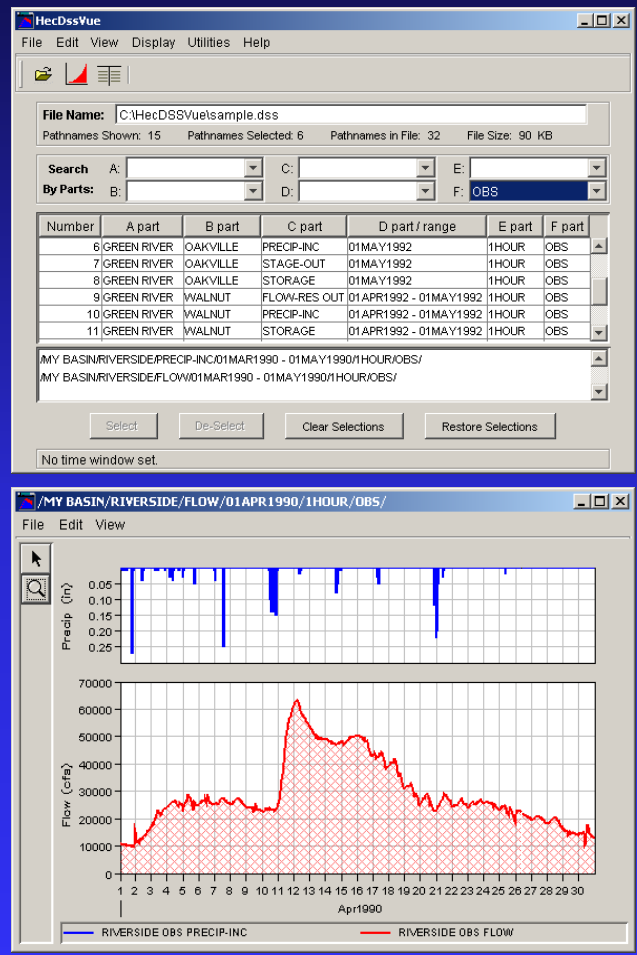
CWMS Decision-support Modeling



Study adaptation - WAT – underway.

HEC-DSSVue, Data Management
Version 1.0 Release January 2003

- Efficient time-series (including grids), paired-data, and text data management; integrated math-function library.
- GUI interface; supports user-customized tabulations and displays.
- Provides mechanism for HEC, and other, models integration.

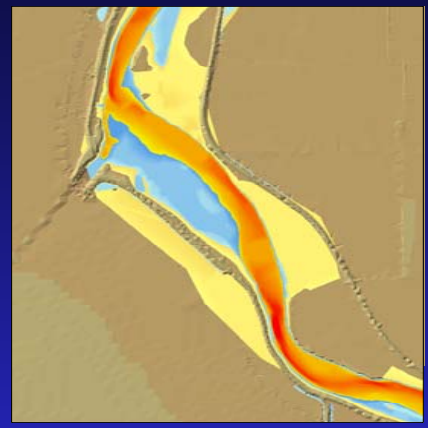


HEC-EFM Ecosystems Functions
Under development, Beta Version

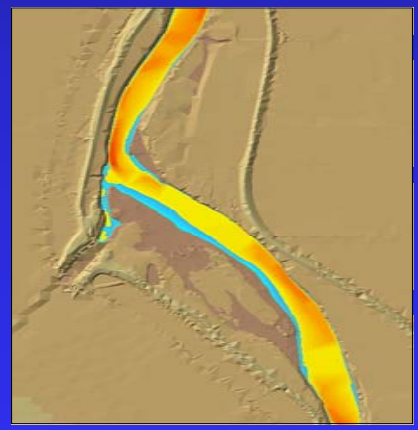
- Evaluation tool for flow regime change.
- Reservoir/regulation change, diversions, remove/set back levee, reconfigure channel.
  - Impact on terrestrial and aquatic habitat.
  - Change direction/magnitude - biologic impact.
  - Team use: biologists, geomorphologists, hydraulic engineers, environmental managers.
- Premise: hydrologic/hydraulic data can help predict biologic response.

EFM Application – California
Central Valley Comprehensive Study

- Applied to riverine and adjacent floodplains for aquatic and terrestrial habitat changes.
- Requirements: select area, geo-referenced hydraulic model, flow/stage data, ecosystem response physical/biological relationships, GIS coverages.
- Results: Change - more/less area – enhanced?



Spawning Habitat



Cottonwood Recruitment

Summary

- Modern suite of hydrologic engineering, planning analysis, and emerging ecosystem functions models developed, supported.
- Object-oriented design and coding proven as powerful software concepts and tools.
- Move from legacy batch software to event loop, GUI-driven, integrated model suite essential and successful. More to come.
- HEC software continues to be public domain, with Corps and vendors supported.